

## DEPLETED URANIUM DECON

5-57. Depleted uranium (DU) is an extremely dense metal used in munitions to penetrate heavy armor or as protective shielding (armor packages). DU is also used as equipment components. All components containing radioactive isotopes are listed in TB 43-0116.

5-58. DU Depleted uranium exposure and incidents may occur anytime there is damage to the DU armor package, a vehicle is hit with DU munitions, DU munitions are damaged, or equipment components containing DU are damaged. The DU armor can be damaged during vehicle maneuvers, on-board fires, maintenance activities, or ballistic impacts. DU munition problems may occur during storage, transportation, combat, testing, or manufacturing. DU contamination may be present on the ground in areas where equipment was destroyed or damaged.

5-59. DU contamination may include DU oxides (dust), contaminated shrapnel, munitions components, or armor components. DU emits primarily alpha particles; however, beta, gamma, and x-ray ionizing radiation are also emitted. DU contamination could be inhaled, ingested, or injected. DU contamination does not pose an immediate health risk. Consequently, contamination should be removed from personnel or vehicle surfaces when directed by the unit commander based on METT-TC.

5-60. Visual signs that DU contamination is present include heavy, dull-black dust or small round holes. DU contamination can only be verified with a radiacmeter. An AN/VDR-2 or AN/PDR-77 with an alpha probe or beta (flat pancake) probe (RPO kit) is used to detect and measure DU contamination.

5-61. Wear your assigned protective mask when working on or within DU contaminated equipment. Depending on temperature, protective ensemble availability, DU-contamination levels, and tasks to be performed, soldiers can wear the battle-dress overgarment or coveralls or they can roll down their sleeves and blouse their trousers as directed by unit chemical or medical personnel.

5-62. General decon procedures follow:

- Use a radiac to determine if DU contamination is present.
- Provide protection, including appropriate clothing, for workers as directed by unit chemical or medical personnel.
- Identify what is to be decontaminated.
- Obtain necessary equipment and materials (Appendix D).
- Brush, wash, or wipe off contamination with a damp cloth. Use a HEPA filtered vacuum cleaner if available.
- Work from the outside of the contaminated area to the inside.
- Cover fixed contamination with tape, paint, paper, plastic, or other disposable material.
- Use the standard double bag and tag process for hazardous waste. The only contaminated waste generated by DU will be the vacuum-cleaner bags after use on multiple vehicles.

- Continue the decontaminating process until contamination levels are reduced to the appropriate level (see Table 5-1).
- Decon personnel and equipment according to Chapter 4.

**Table 5-1. Recommended Maximum Permissible Contamination Levels**

Contaminated Item	Corrective Action	Maximum Alpha		Maximum Beta	
		Fixed <sup>1</sup> (dpm/100 cm <sup>2</sup> )	Remove-able <sup>2</sup> (dpm/100 cm <sup>2</sup> )	Fixed <sup>1</sup> (mrad/hr at 2.5 cm)	Remove-able <sup>2</sup> (dpm/100 cm <sup>2</sup> )
1. Personal clothing, including shoes	See note 1	200	None	0.05	None
2. Protective clothing					
a. General	See note 1	1,000	200	0.02	1,000
b. Respirators	See note 1	200	None	0.06	None
c. Laundry	See note 2	--	--	--	--
3. Work area and equipment (unrestricted use)	See note 1	5,000	500	0.05	500
4. Vehicles (unrestricted use)	See note 3	1,000	500	0.05	500
5. Skin					
a. Body	See note 4	200	None	0.06	None
b. Hands	See note 4	400	None	0.06	None
<sup>1</sup> Measured with a calibrated radiation measurement instrument <sup>2</sup> Determined using smears analyzed with a calibrated counting system <b>NOTES:</b> 1. Replace or dispose of radioactive waste if above limits 2. Release only to NRC licensed launderer, if contaminated, or dispose as radioactive waste 3. Decontaminate if above limits 4. Continue decon if above					

## CONTAMINATED REMAINS DECON

5-63. Mortuary affairs personnel establish and operate the mortuary affairs decontamination collection point (MADCP). When an NBC event has occurred on the battlefield, there is a very high probability that many deceased personnel were exposed to contaminating agents. If the situation does not lend itself to the determination of a hazard on an individual basis, all remains within the affected area will be treated as if contaminated. If the theater surgeon or his staff determines that biological agents have been employed, all remains will be treated as if contaminated.

5-64. Whenever the threat of NBC warfare exists in a theater of operations, the unified commander will direct the Joint Mortuary Affairs Office (JMAO) to be prepared to handle contaminated remains. The JMAO will serve as the theater central point of coordination for the operation. Joint operations of contaminated remains are described in Joint Publication 4-06, Appendix D.

5-65. Personnel support is required after completing the evacuation mission to the MADCP. Detailed troop decon takes about 1 hour. The MADCP site will require a complete detailed decon by a chemical decon unit.

## **RADIOLOGICAL DECON**

5-66. Radiological contamination may occur in the form of one element. In this section, the decon of six specific, commonly found radioactive elements is discussed. The discussion is applicable not only to these elements but also to other elements having similar chemical properties.

### **CESIUM**

5-67. The common radioisotope of cesium is cesium-137. It emits beta and gamma radiation, decaying to stable barium-137. Cesium-137 is widely used in gamma sources. It occurs in these sources as cesium-chloride pellets. Cesium chloride is a soluble salt. The contamination from a sealed-source leak absorbs water, becomes damp, and creeps. Contamination from a sealed cesium source is best decontaminated by wet procedures unless the contamination is on a porous surface, in which case, wet procedures should be preceded by vacuuming. Cesium is known to adsorb from solution onto glass surfaces. Decontaminating a cesium liquid-contaminated surface is best accomplished by wetting the surface, absorbing the solution with a rag or other absorbent material, and rinsing the area several times with water. If the contamination persists, brushing and detergent solution should be used. A cesium-contaminated solution that has been standing for some time is best decontaminated by absorbing any remaining liquid, treating the surface several times with water (allowing the water to stand on the surface for about 1 minute each time), and then absorbing the liquid from the surface. If the contamination remains, further treatment depends upon the surface. Metallic surfaces are treated with strong mineral or oxidizing acids. Waxed surfaces are removed. If contamination still persists, abrasives or other removal techniques are used.

### **COBALT**

5-68. The common radioisotope of cobalt is cobalt-60, a beta gamma emitter. Metallic cobalt-60 is commonly used in sealed gamma sources. Particles of cobalt dust adhering to small articles are readily removed by ultrasonic cleaners or by dipping in a dilute solution of nitric, hydrochloric, or sulfuric acid. Cobalt-dust contamination that exists over a large area is best removed by vacuuming. Sealed cobalt sources may leak as a result of electrolytic action between cobalt and the container. The result is often a soluble cobalt salt, which creeps and spreads. This is best decontaminated with a detergent or an EDTA solution, followed by treatment with mineral acids. Contamination from solutions containing cobalt may be treated with water.

### **PLUTONIUM**

5-69. The most common isotope in which plutonium may be present as a contaminant is plutonium-239, an alpha emitter. This isotope is present in the AN/UDM-6 calibration source. Plutonium contamination may be a result of a nuclear

weapon accident, in which case, the plutonium will be scattered as a metal or oxide in a dust form. Both forms of plutonium are insoluble. Aging of plutonium-239 contamination is impractical since it has a 24,000-year half-life. Plutonium contamination that covers a small area is best decontaminated by vacuuming. If contamination remains, the area should be washed with a detergent solution. Any contamination that remains can be sealed in a protective coating of paint, varnish, or plastic. Plutonium oxide or metal dust spread over a large area, such as a field, is best decontaminated by removing the top layer of soil and disposing of it as radioactive waste. Personnel should wear respiratory protection when decontaminating or moving the soil.

## **STRONTIUM**

5-70. The most common radioisotope of a strontium is strontium-90, a beta emitter. The daughter particle of strontium-90 is yttrium-90, which is also a beta emitter. Strontium-90-yttrium-90 is commonly used in sealed beta sources such as the M6 source. Generally, it is present as chlorine or carbonate. The chlorine is hygroscopic; it absorbs water and creeps out of the container. This contamination is best decontaminated by vacuuming, followed by treatment with water, a complexing agent solution, and mineral acid (in that order). Contamination resulting from a dilution containing strontium is best decontaminated by absorbing the solution and washing the area with a detergent solution. If strontium contamination persists, the top layer of the surface should be removed by abrasives or other removal procedures and a sealing coat should be placed over the surface.

## **TRITIUM**

5-71. Tritium is the radioisotope of hydrogen and is a weak beta emitter. If it is released to an area as a gas, the best decon method is to flush the area with air. Since inhalation of tritium can present an internal hazard, personnel entering an area containing tritium gas should wear an appropriate self-contained type of breathing apparatus. Objects in an area exposed to tritium for a length of time may absorb the gas and should be disposed of, if possible. They may be degassed, under a vacuum, by flushing with helium or hydrogen. A surface which monitors clean may be contaminated again in a matter of hours by percolation to the surface of absorbed tritium. There is no practical way of removing tritium oxide (T<sub>2</sub>O) from water due to its similarity to natural water.

## **URANIUM**

5-72. The most probable source of uranium contamination is a nuclear weapon accident in which the fissionable uranium is spread as a metal or oxide dust. The common isotopes of uranium contamination are uranium-235 and uranium-238. This metal or oxide is insoluble and is best removed from a contaminated surface by brushing or vacuuming, followed by treatment with mineral acids or oxidizing acids, and then sealing. Large-area uranium contamination is best decontaminated by removing the top layer of the surface or by sealing it.